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ABSTRACT

The findings of eight reviews of process-product studies are synthesized. Results are organized under the main headings of time, instructional organization, monitoring, management, instruction, and environment. The paper begins with a brief history of research on teacher effectiveness, a description of the process-product paradigm, and a discussion of some of the problems characterizing this type of research. The studies suggest that the effective teacher (primarily of low SES children in the primary grades) is one who (1) uses time efficiently, keeping students engaged with task-related activities: (2) organizes students into medium to large groups for instruction, (3) correctly monitors work while being available to provide answers to student-initiated questions: (4) assumes the role of a strong leader: (5) asks low-order questions, ensures that students have the opportunity to learn sufficient amounts of content, keeps interaction at a low level of complexity, structures lessons so that students are aware of objectives: and (6) sustains a classroom environment that is warm, friendly, democratic, and relatively free of disruptive behavior. (Author/CTM)

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INSTRUCTIONAL VARIABLES AND STUDENT ACHIEVEMENT IN READING AND MATHEMATICS: A SYNTHESIS OF RECENT PROCESS-PRODUCT RESEARCH

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INSTRUCTIONAL VARIABLES AND STUDENT ACHIEVEMENT IN READING AND MATHEMATICS: A SYNTHESIS OF RECENT PROCESS-PRODUCT RESEARCH

Frances K. Ruff

May 1978

ABSTRACT

The findings of eight reviews of process-product studies are synthesized: Berliner and Rosenshine, 1977; Centra and Potter, 1977; Gow, 1977; Medley, 1978; Rosenshine, 1976, 1977; Soar, 1975; Soar and Soar, 1977. Results are organized under the main variable headings of time, instructional organization, monitoring, management, instruction, and environment. The paper begins with a brief history of research on teacher effectiveness, a description of the process-product paradigm, and a discussion of some of the problems characterizing this type of research.

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INTRODUCTION

Teacher effectiveness research has long occupied a central position within the broader field of research on teaching. As Doyle (1977) points out, studies which have attempted to distinguish superior from inferior teachers have been conducted since the 1920s, increasing in number since the 1950s with the formation of the AERA Committee on Criteria of Teacher Effectiveness (American Educational Research Association, 1953). For a brief period, reports such as those of Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld, and York (1966), Jencks, Smith, Acland, Bane, Cohen, Gintis, Heyns, and Michelson (1972), and Mosteller and Moynihan (1972) raised doubts about the influence of teachers on students' achievement in schools and led to controversy concerning the value of teacher effectiveness research. These reports, however, were criticized on methodological grounds (e.g., Centra & Potter, 1977; McPartland, Epstein, Karweit & Slavin, 1976). At the time of their 1977 review, Berliner and Rosenshine summarized the general feelings of the research community toward the conclusions drawn in these reports in saying that "it is no longer acceptable to take seriously those who minimize the impact of the teacher on the students' acquisition of knowledge" (p. 381). Investigations of teacher performance have thus continued to flourish. The recent emphasis given to the development of performance- and competency-based approaches to teacher education, evaluation, and accountability highlights the importance of the teacher effectiveness question in current research.

Because of its long history, research on teacher effectiveness has taken several forms. Early research attempts focused primarily on discovering desirable teacher characteristics, which most often were inferred from ratings given to teachers by students or principals. As Medley (1978) notes, what resulted from these early studies were prescriptions resembling boy scout laws for teachers, such as "a teacher is warm, attractive, and kind." Research of this type continued until the 1950s and, although interesting, produced relatively few outcomes that could systematically be applied in evaluating teacher effectiveness. Dunkin and Biddle (1974) quote the Committee on Criteria of Teacher Effectiveness (AERA, 1953) in addressing the inadequacy of early research:

> The simple fact of the matter is that after 40 years of research on teacher effectiveness during which a vast number of studies have been carried out, one can point to few outcomes that a superintendent of schools can safely employ in hiring a teacher or granting him tenure, that an agency can employ in certifying teachers, or that a teacher-education faculty can employ in planning or improving teacher-education programs. (p. 657)

Among the reasons for the failure of this research to produce useful information, Dunkin and Biddle (1974) note the following: (1) failure to observe teaching activities, (2) theoretical impoverishment, (3) use of inadequate criteria of effectiveness, and (4) lack of concern for contextual effects.

During the late 1950s, researchers initiated changes in an attempt to address these problems. The most significant departure from earlier

research was the relative abandonment of efforts to discover specific teacher characteristics. For the first time, researchers began to focus on the actual processes that characterize teaching in the classroom. They began to rely heavily on observational techniques to delineate teaching behaviors, and on objective measures of student outcomes to differentiate between desirable and undesirable teaching practices. The goal of research on teacher effectiveness for about the past two decades has thus been to establish relationships between teaching behaviors (and more recently, student behaviors) and student achievement in cognitive and affective areas. The term "process-product" has been applied to this research because it attempts to relate classroom processes to student products (Rosenshine, 1971).

A great number of process-product studies have been conducted since the fifties. Dunkin and Biddle (1974) noted at the time of their review that hundreds of studies of teacher effectiveness had been published which used classroom observation techniques. They further commented that the need to evaluate the findings of these studies had made reviews of the literature in the field "almost yearly events" (e.g., Withall, 1960; Medley & Mitzel, 1963; Meux, 1967; Biddle, 1967; Nuthall, 1968, 1970; Flanders & Simon, 1970; Rosenshine, 1971; Rosenshine & Furst, 1973). Since Dunkin and Biddle's (1974) review, several large-scale studies have been conducted (e.g., McDonald & Elias, 1975; Soar, 1973) which have contributed substantially to the knowledge base in process-product research. Accordingly, reviews of the literature have continued to

flourish in order to help assess and integrate the results presented in these reports (e.g., Rosenshine, 1976, 1977; Gow, 1977; Centra & Potter, 1977; Berliner & Rosenshine, 1977; Medley, 1978b).

This paper takes the review process one step further. It attempts to synthesize the conclusions drawn by recent (since 1975) reviewers of the literature in order to arrive at an even more integrated view of the state of the art of process-product research. (Recent reviews are looked at exclusively, since these most clearly reflect current thinking.) More specifically, there were two primary reasons why this review was initiated. First, the review was initiated to facilitate the efforts of the Basic Skills Component by providing a concise and well-integrated presentation of the results of teacher effectiveness research which could be used to assist practitioners in developing their capabilities to improve instruction in schools. Second, it was felt that a review of this type could assist members of the educational research community assess recent progress made on the teacher-effectiveness question and subsequently help guide future research.

The paper begins with a brief explanation of the process-product paradigm and a discussion of some problems currently affecting research on teacher effectiveness.

THE PROCESS-PRODUCT PARADIGM

Doyle (1977) writes cogently on the underlying assumptions, effectiveness, and recent directions of the process-product paradigm. Most of the information in this section has been taken from his paper although chapter 3 from Dunkin and Biddle (1974) has contributed significantly.

As stated in the introduction, the teacher effectiveness question within the process-product paradigm is defined in terms of relationships between teacher classroom behaviors (processes) and measures of student learning outcomes (products). Doyle cites Gage (1963) in saying that this approach is based on a two-factor "criterion-of-effectiveness" structure that relates teacher variables directly to indicators of effectiveness. Doyle presents Rosenshine's (1971) description of the basic stages of a process-product study:

> (1) the development of an instrument which can be used systematically to record the frequency of certain specified teaching behaviors; (2) use of the instrument to record classroom behaviors of teachers and their pupils; (3) a ranking of the classrooms according to a measure of pupil achievement adjusted for initial difference among the classes; and (4) a determination of the behaviors whose frequency of occurrence is related to adjusted class achievement scores. (p. 18)

Drawing from Gage's (1966) work, Doyle notes that the results of process-product inquiries are expected to have direct practical application for teacher education and school improvement efforts in addition to providing information in response to purely theoretical research questions. He comments that these practical considerations have

influenced research in this field by "directing choices about which process dimensions to measure, which to manipulate, and how to interpret the findings" (p. 6).

"Process variables" as defined by Dunkin and Biddle (1974) are based upon "all of the observable behaviors of teachers and pupils rather than upon only those that are productive of pupil growth or upon intangible or unobservable relationships between teachers and pupils" (p. 44). This, however, should not be taken to mean that the effects of student behavior or teacher behavior (or vice versa) are discounted, but rather that in order for such effects to be considered true process variables, they must be able to be measured by overt behavioral signs. This distinction is an important one. Since the onset of process-product research, primarily because of the emphasis on teacher effectiveness research, classroom processes have been defined in terms of teacher classroom behavior. Although Dunkin and Biddle include pupil behavior in their definition, little attention has been given to such processes, or to the causal "mediating" relationships between teacher behavior and pupil behavior, until recently (Anderson, 1977; Centra & Potter, 1977; Doyle, 1977). Evolving paradigms for "teacher effectiveness" research are modifying the process-product model to incorporate such mediating variables.

"Product variables," again as defined by Dunkin and Biddle (1974), refer to the outcomes of teaching, i.e., to "those changes that come about in pupils as a result of their involvement in classroom activities

with teachers and other pupils" (p. 46). The product variables most often investigated are those that measure short-term learning in a subject matter, usually reading or mathematics. Some researchers, however, (e.g., Medley, 1978b) suggest that product variables should reflect long-term gains in studies whose results are to be used for answering the teacher effectiveness question.

Figure 1 presents "a model for the study of classroom teaching" as presented by Dunkin and Biddle (1974, p. 38). Although models are changing (e.g., to include ecological approaches to research), the model offered by Dunkin and Biddle is generally most representative of the main lines of thinking about teacher effectiveness research during the past twenty years.

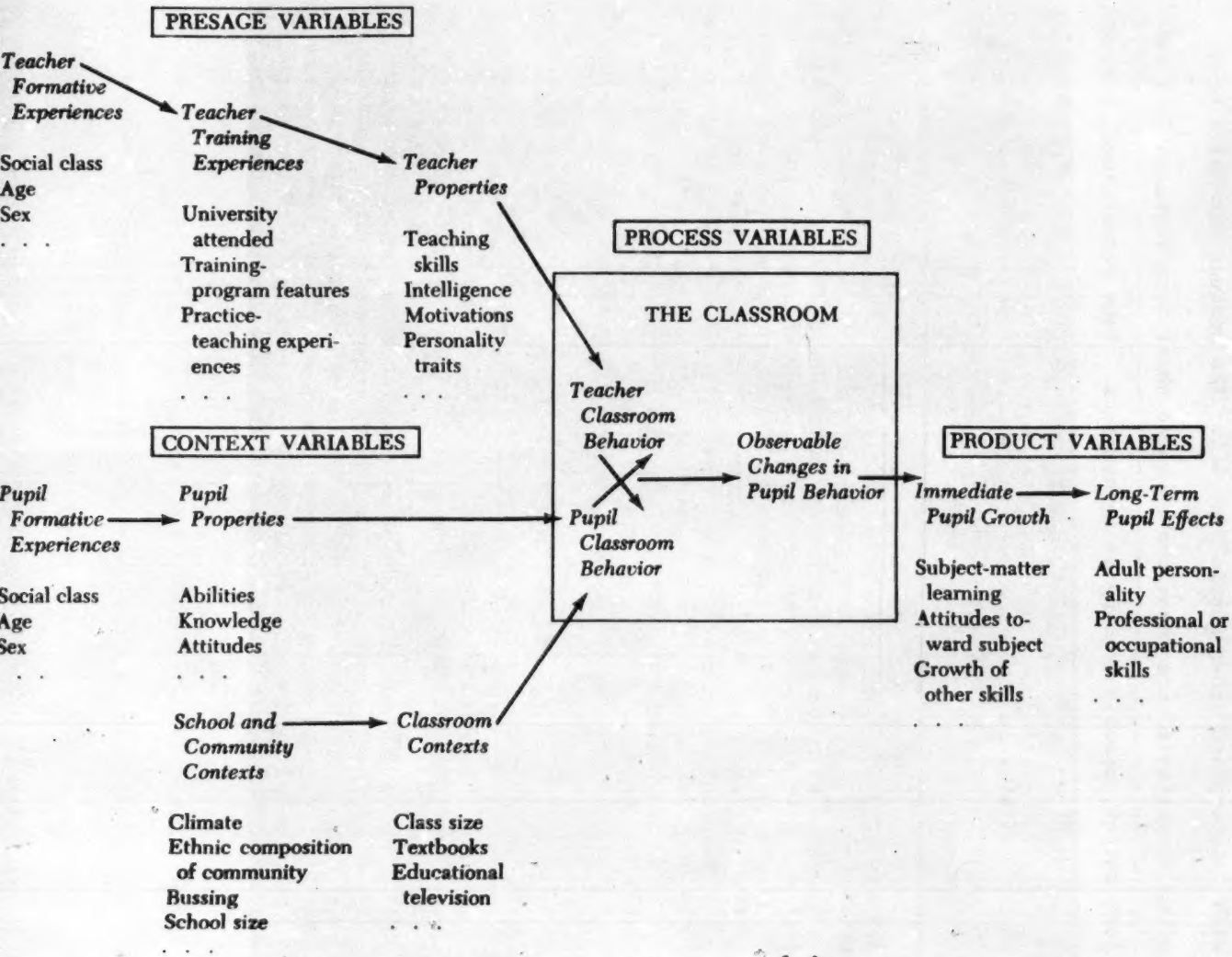

Figure 1. A model for the study of classroom teaching.

PROBLEMS AFFECTING PROCESS-PRODUCT RESEARCH

Researchers of teacher effectiveness, especially for the past two decades, have been motivated by the desire to transform teaching into an empirically based science, and by the belief that the process of teaching is amenable to scientific inquiry, namely that the activities of teaching are rational events which are observable and quantifiable and which have discoverable causes and effects (Dunkin & Biddle, 1974). Given the problems which characterized earlier research on teacher effectiveness efforts, process-product research has contributed significantly to the start of an empirical knowledge base of effective teaching behaviors. However, as the researchers themselves admit, problems of productivity, methodology, and theory plague this type of research.

A brief discussion of these problems is included here to alert the reader to their existence and to provide a more realistic basis by which to assess the conclusions presented in the paper. Many researchers have described the problems affecting process-product research (Centra & Potter, 1977; Berliner, 1976; Doyle, 1977; Dunkin & Biddle, 1974; McDonald & Elias, 1975; Medley, 1978b). Since Berliner's (1976) paper deals exclusively with the formulation of these problems and incorporates most of the issues addressed by other researchers, the discussion which follows is based primarily on his writing.

According to Berliner (1976), the problems which characterize process-product research may be divided into three categories: instrumentation, methodology and analysis. Problems with instrumentation refer to

difficulties encountered in clearly defining and operationalizing dependent and independent variables. In the case of dependent variables, the question is one of finding appropriate instruments to assess the effects of teaching. As Berliner points out, if off-the-shelf standardized tests are used, one runs the risk of not measuring the actual content that was taught in the classroom. Results may show weak correlations between teaching processes and student achievement merely because the tests used to measure achievement are "more reactive to family background and ethnicity than they (are) to instructional events" (p. 6). If tests for special teaching units* are designed to help ensure that the tests being used are content valid for a particular classroom, then the alternate problem which surfaces is one of reliability. Are measures of teacher effectiveness arrived at during a short period of time appropriate for longer periods? Finally, dependent measures rarely address simultaneously what students learn and what they feel about that learning a situation which, Berliner feels, provides an unrealistic view of students' perception of learning in schools.

The first problem connected with independent variables used in teacher effectiveness studies is with the "appropriateness of teacher behavior" as defined by Berliner or, similarly, the "context of behavior" according to Medley (1978a). The concern here is with the type of

* Teaching units are specially designed mini-courses which can be used to try to control what teachers teach and what students are exposed to.

observation instruments used in process-product research. These typically code only the frequency of teacher behaviors; they are not constructed to record the teacher's intent or purpose for eliciting certain behaviors, or to take into account the context of behavior. As a result, the full implications of teacher behaviors are not studied and, in fact, results which are obtained are often inaccurate or misleading. The second problem is that of determining the appropriate unit of analysis for the independent variable. As Berliner notes, researchers are very aware of the difficulties in deciding on the relative appropriateness of different characterizations of independent variables (for instance, should they consider the single teacher question as the unit of analysis or the question along with the wait-time?). A third problem with defining independent variables concerns the stability of teacher behavior. Berliner (1976) suggests that much more must be learned about "which teacher behaviors fluctuate, and how and why they fluctuate over time, settings, curricula, and populations" (p. 9) before valid claims can be made about the relationships between teacher behaviors and student outcomes.

A second set of loosely related problems and issues deals with methodology. The most pervasive of the problems in this group is one which has received much discussion and caused much controversy, namely, the problem of estimating how much one can legitimately expect teachers and schools to influence student achievement. The reports of Coleman et al. (1966), Jencks et al. (1972), and Mosteller and

Moynihan (1972), although criticized on both methodological and statistical grounds (e.g., Berliner & Rosenshine, 1977; McPartland et al., 1976; Spady, 1976), imply that schools have minimal effect on student achievement, and that factors such as intelligence, ethnicity and socioeconomic status are the major determinants of school outcomes.

A second related methodological problem concerns the subject matter(s) in which student achievement is expected, or at least tested for, in teacher effectiveness studies. Based on the findings of the International Education Association (IEA) cross-cultural study of student achievement (Postlethwaite, 1973), performance in subjects like reading and social studies is influenced to a large extent by home variables, more so than achievement in curriculum areas like physics and French which are more likely to be influenced by differential classroom instruction. Berliner cautions that researchers should perhaps discontinue the use of achievement measures in areas such as reading (one of the most common areas students are tested in) and concentrate on areas where the greatest teacher effects might be seen.

Another issue which Berliner (1976) and Medley (1978a) discuss arises from the fact that much of the research on teacher effectiveness is norm-referenced. Because of the normative nature of these studies, some teachers will always appear to be better than others, but in fact the entire sample may be poor when judged against an absolute standard. Medley highlights this problem by asking: (1) How good do we want effective teachers to be? and (2) Will researchers and all

others interested in improving teaching accept levels of teaching established through such studies as representing competent teaching? Berliner suggests that when speaking of teacher competence researchers should refer to "more and less effective" teachers rather than using the terms effective and ineffective, which imply that teachers are being judged against an absolute standard.

Four final methodological issues that need to be mentioned are:

1. The very nature of teacher effectiveness research masks teaching behaviors that are differentially effective for pupils of differing aptitudes, styles, personalities, and traits;
2. Typical research-of-teaching designs do not take into account the fact that teacher behavior does not influence student achievement directly but is mediated by the student's own behaviors and perceptions;
3. Definitions of independent variables often lack the precision needed to measure their occurrence adequately;
4. The question exists as to whether teachers maintain the same level of effectiveness over time and over subject matter areas.

In discussing statistical problems related to research on teacher effectiveness, Berliner (1976) points out that the issue is one of how to measure change without a true experimental design. He comments that, although a whole range of statistical techniques has been examined, these still fall short of providing very reliable results.

Finally, a problem which results from all the other issues described is low productivity. Although process-product studies are numerous, their results are often disparate, not comparable, or at worst invalid, making it difficult for conclusions to be drawn.

Consequently, after many years of research, relatively few definitive statements can be made about effective teaching. As Centra and Potter (1977) comment, however,

> although research has not provided a (sound) foundation for planning empirically based change, it has yielded . . . signposts on which significant progress can be based. The administrator planning for educational improvement in schools would be well advised to begin planning from this base. (p. 32)

Centra and Potter's position reflects the one taken in this paper in attempting to present a synthesis of the findings of process-product research which may be used by practitioners for school improvement.

A SYNTHESIS OF PROCESS-PRODUCT RESULTS

The findings of eight reviews of the literature will be synthesized in this section. Where appropriate, the studies on which the reviewers have based their conclusions will be specified so as not to create what Medley (1978b) refers to as "a spurious consistency in appearance," i.e., a situation in which results gain in credibility because several reviewers have reviewed and based their conclusions on the results of the same studies. Conclusions about effective teaching practices that relate to student outcomes in areas other than reading or mathematics will not be presented, since the purpose of the paper is to synthesize findings exclusively in these two areas. The findings of the synthesis are reported by variable. No particular variable classification system found in the literature has been used, e.g., the Cooley-Lohnes (1976) constructs and variables, McDonald's (1975) variable classification system, or Medley's (1978b) classifications. Rather, the results of the reviews were allowed to speak for themselves and suggest their own organization.

This section is headed by a brief description of the reviews included in the synthesis, in which the reviewers' purposes, approaches, and constraints are discussed. In addition, where it seems to be warranted, criticisms or cautions raised against the reviews are noted.

The Reviews

Anyone interested in process-product research through the years has come to depend on the reviews of Barak Rosenshine. The findings of two reviews that he has authored (Rosenshine, 1976, 1977) and one that he has co-authored with David Berliner (Berliner & Rosenshine, 1977) have been included in the synthesis. Although Rosenshine has had other reviews which are frequently quoted in the literature (Rosenshine, 1971; Rosenshine & Furst, 1973), these have not been considered since they reflect less recent trains of thought and do not summarize results of several key studies conducted since the times of their publication. The three reviews which have been included are related substantively to one another, the two 1977 articles expanding and clarifying the earlier one.

The objective of the 1976 review, which appears in the NSSE yearbook of that year, is to describe the major recent studies in classroom instruction and their results. Reviews of results on six variables are offered: time spent, content covered, work groupings, teacher questions, child responses, and adult feedback. The first three of these variables were selected since, according to Rosenshine, they appear to be important and are frequently overlooked in classroom research. The last three variables were selected because they have frequently been studied in classroom research. Most of the results which Rosenshine summarizes in this review come from the Follow Through studies of Stallings and Kaskowitz (1974) and Soar (1973),

and from the Texas Teacher Effectiveness Study by Brophy and Evertson (1974). An attempt is made to integrate the results for each variable into a "Direct Instructional Model." Rosenshine explicitly states at the beginning of the review that its scope is deliberately limited to primary-grade instruction in reading and mathematics for children of low socioeconomic status in order to achieve "a sharper focus." This, however, is also due to the characteristics of the samples in the studies on which Rosenshine focuses.

The article by Berliner and Rosenshine (1977), which appears as a chapter in Schooling and the Acquisition of Knowledge, presents a description of how knowledge is acquired in the classroom. The authors begin the review by stating that attempts to study knowledge acquisition must, at a minimum, "focus on the curriculum to be taught, the method by which information is communicated, and the teacher's role in fostering the acquisition of knowledge and skills so that classroom instruction is interesting, comprehensible, and pleasant" (p. 375). The review discusses results for essentially the same types of variables found in the earlier review, although the authors also draw from the results of two new studies: McDonald (1975) and Tikunoff, Berliner, and Rist (1975). Commenting on the article, Phillip W. Jackson (1977) of the University of Chicago states that Berliner and Rosenshine have been too optimistic in their appraisal of the results of research and suggests that researchers of teaching should reevaluate their techniques and perhaps also their goals.

The third review by Rosenshine, which was presented at the 1977 annual meeting of the American Educational Research Association, is essentially a summary of the previous two reviews. At the beginning of the article, Rosenshine notes that three major changes in thinking have occurred since 1973 with respect to the types of inquiries researchers believe will suggest the most productive instructional strategies:

1. An increased focus on student variables such as content covered (or opportunity to learn) and student attention to relevant academic activities,
2. A convergence of results supporting several components of a model of "direct instruction," and
3. New information on the proportion of student time spent in seatwork and in discussion, with implications for the role of the teacher. (Rosenshine, 1977, pp. 1-2)

The review conducted by Doris Gow (1977) of the Learning Research and Development Center (University of Pittsburgh) was commissioned by the Pennsylvania School Improvement Program (PSIP), a consortium of agencies that work closely with schools to help them use research and development information for self-improvement. A synthesis of research was needed in order to more knowledgeably prescribe improvement strategies for target schools. The approach of the review is thus very practical. Research information is limited to the basic skills areas and is presented according to the Cooley-Lohnes (1976) constructs: opportunity, motivators, structure, and instructional events.

A paper prepared by John A. Centra and David A. Potter (1977)

for Research for Better Schools as part of their study of school variables, begins with a justification of a within-school (as opposed to a between-school) approach to the study of instructional variables. The discussion of within-school factors is further organized according to school variables and teacher variables. The review concludes with a lengthy discussion of the implications of the results presented for practice and research.

A paper by Robert Soar (1975), and one by Robert Soar and Ruth Soar (1977) summarize findings for four of those authors' previous studies of teacher effectiveness. The more recent paper reiterates the conclusions presented in the earlier paper by presenting a paradigm for thinking about classroom management and environment. The four studies, whose results were integrated, are as follows:

> Study SC 3-6 (Soar, 1966, 1968) involved fifty-five urban classrooms in central South Carolina, grades three through six, all white pupils, spanning all socioeconomic levels but with the upper levels overrepresented. Study FT 1 (Soar & Soar, 1972) involved twenty first grade classrooms in Project Follow Through, with both black and white pupils, predominantly disadvantaged. Study Fla 5 (Soar & Soar, 1973) involved fifty-nine fifth grade classrooms in north Florida, including all levels of socioeconomic status but with the lower levels more strongly represented, and was divided approximately evenly between black and white, boys and girls, rural and urban. Study Fla 1 (Soar & Soar, 1973) also from north Florida, had twenty-two first grade urban classrooms, with black and white pupils, spanning the socioeconomic status levels. (Soar & Soar, 1977, p. 1)

The most recent review and the last of those included in the synthesis, is that of Donald Medley (1978b), which was commissioned by the

Committee on Performance-Based Teacher Education (PBTE) of the American Association of Colleges for Teacher Education (AACTE). In the words of the author, the primary purpose of the report is "to provide the teacher educator with access to the meaningful findings of research in teacher effectiveness" (Medley, 1978b, p. 1). It is helpful to note, however, that Medley acknowledges the interim nature of the findings and explicitly states that he has attempted to present information which can be used to improve teacher education now while researchers strive for more definitive results.

Medley's approach to the review is unique and demands some explanation. From an original list of 732 studies discussing effective teaching practices, 289 remained after an initial weeding-out process that rejected studies primarily if they reported no original research, i.e., if they were reviews of the literature or discussed what good teachers should do without presenting data. The 289 items which remained were examined for the type of process-product relationships they reported. Four criteria were used in deciding whether a relationship should be included in the review:

1. The study from which a relationship came had to be designed so that the relationship was generalizable to some population of teachers larger than the sample studied.

2. The relationship had to be both reliable enough to be statistically significant and large enough to be practically significant.

3. The measure of teacher effectiveness had to be based on long-term pupil gains in achievement areas recognized as important goals of education.

4. The process measure had to specify the behaviors exhibited in such a way that they could be reproduced as desired. (Medley, 1978b, p. 5)

After these criteria had been applied to all the relationships reported between teacher behaviors and pupil outcomes, 613 relationships remained, coming from just 14 of the 289 studies. These 14 studies are: Brophy and Evertson (1974); Bemis and Luft (1970); McDonald and Elias (1976); Harris and Serwer (1966); Harris, Morrison, Serwer and Gold (1968); Good and Grouws (1975); Soar (1966, 1973); Soar and Soar (1972, 1973); Stallings and Kaskowitz (1974); Solomon and Kendall (1976); Spaulding (1965); and Coker, Lorentz, and Coker (1976).

In the review, relationships are presented in tables to enable readers to draw their own conclusions. Medley, however, also offers his own intepretation of the findings, organizing behaviors which differentiate between effective and ineffective teachers into three constructs: (1) maintenance of learning environment, (2) use of pupil time, and (3) quality of instruction.

Another unique feature of this publication is the inclusion in an appendix of the comments addressed to the first draft of the paper by a review panel of experts set up by the PBTE Committee to assist Medley in his task. The comments, most of which are highly complimentary, provide an immediate source to which the reader may turn for elucidation and appraisal. Although these comments will not be summarized here, one raised by several reviewers is worth noting. In drawing his own conclusions, Medley suggests that different types of

instruction appear to be differentially effective for students of low and high socioeconomic status. Several reviewers note that, although this may be essentially true, several factors must be considered which may be operating in making them true (e.g., language, cultural differences, nutrition). In addition, such findings seem potentially dangerous if they are misinterpreted and not properly elaborated.

A Synthesis of Results

In trying to integrate the varied results of process-product research into larger and more meaningful patterns, individual reviewers, as would be expected, have developed different constructs or organizational schemes in which to fit the findings. Medley (1978b), for instance, fits results that relate to work groupings within the larger organizational variable "use of pupil time," whereas Rosenshine (1976, 1977) summarizes findings for work groupings along with several other variables, under the variable "direct instruction." The synthesis presented here has tried to ignore the various organizational variables employed by the different reviewers and, instead, has let the results suggest their own schemes. When all is said and done, the fact remains that research results could probably be organized in a different way by anyone undertaking such a task. This, however, is not as disheartening as it first sounds, since with each new attempt to make sense out of process-product data, new insights may be found or new ideas suggested which may extend current thinking.

Time

The concept of time in various forms energes as one of the most discussed and perhaps one of the most critical variables relating to student achievement.

The variable of absolute time spent in school, although not a process variable, is briefly discussed here to lend perspective to the rest of the discussion of time. Rosenshine (1976), who draws on the work of Wiley and Harnischfeger (1974) and Harris et al. (1968), and Gow (1977), who also looks at the study by Wiley and Harnischfeger and to one by Bond and Dykstra (1967), conclude that the total amount of time spent in school (calculated from such indices as average daily attendance, length of school day, and length of school year) is positively related to achievement in reading and mathematics. The variable of absolute time spent in school seems important in helping to determine instructional success.

An even more striking determinant of success, however, judging from the conclusions drawn by Berliner and Rosenshine (1977), Gow (1977), Rosenshine (1976, 1977), and Medley (1978b) is the use of absolute time in the classroom. Drawing heavily from the results of the Follow Through Study of Stallings and Kaskowitz (1974), but also on the works of Bloom (1976), Harris and Serwer (1966), McDonald and Elias (1976), and Soar (1973), the reviewers conclude that greater student outcomes are achieved when time in class is spent on task-related "academic" activities rather than on nonacademic activities.

Thus, greater amounts of time spent in the classroom on reading and arithmetic and lesser amounts of time spent on such activities as arts and crafts, music, and dancing were found to correlate with higher achievement scores in reading and arithmetic. As Rosenshine (1976) states, the results suggest that "the stronger the academic emphasis, the stronger the academic results" (p. 345). In a later paper (Rosenshine, 1977), he warns, however, that the critical variable in terms of time usage is not how much time is allotted for academic instruction, but rather the actual number of minutes students are actually engaged in the learning task at hand.

Gow (1977) in her review notes some interesting findings from a paper by Guthrie (in press) on the effects of instructional time on reading. She notes that in Guthrie's study of sixth graders more instructional time benefitted low SES children in word recognition and comprehension, but that increasing amounts of time did not benefit middle SES children and had inconsistent impact on high SES children. These findings are interesting when Soar's work (See Soar, 1975 and Soar & Soar, 1976) is considered. Soar suggests that increasing the amount of time spent on academic activities may only produce marginal returns, i.e., that the function relating time-on-task to student achievement is curvilinear. Guthrie's finding that greater amounts of instructional time were beneficial for low SES children seems consistent with the findings of the other studies noted, whose samples consisted mostly of low SES children.

Instructional Organization

Instructional organization refers here to the ways teachers group students for instruction. Berliner and Rosenshine (1977), Gow (1977), Medley (1978), and Rosenshine (1976, 1977), looking primarily at the results of the Stallings and Kaskowitz (1974) study, conclude that the most effective organization has the teacher working with small groups of three to seven children or with large groups of eight or more children. The reviewers note that in this study, instances of children working alone or of one or two children working with the teacher were consistently negatively correlated with achievement.

Monitoring

Integrally related to the findings concerning work groupings are results that suggest that higher achievement gains are obtained when students' work in groups is supervised by the teacher. Medley (1978b), Rosenshine (1976, 1977), and Soar (1977), drawing primarily from the work of Soar (1973), note that when students work in groups under adult supervision, correlations with achievement are positive and often significant.

Results pertaining to the monitoring of seat work, which essentially may be considered a type of grouping, are consistent with those reported for small groups. Berliner and Rosenshine (1977), Medley (1978b), and Rosenshine (1977) address these findings. Basing their

conclusions on the works of Coker, Lorentz, and Coker (1976), McDonald and Elias (1976), Soar (1973), and Stallings and Kaskowitz (1974), they note that achievement is lower in classes which display the largest amounts of unsupervised seatwork. As Rosenshine (1977) points out, results from the studies of McDonald and Elias (1976) and Stallings and Kaskowitz (1974) imply that unsupervised students are less academically engaged with their tasks than supervised students, a fact that may partially account for the negative correlations with achievement. In the same paper, Rosenshine also cites the studies of Brophy and Evertson (1974) and Good and Grouws (1975) which found that teacher initiated contacts during seatwork were negatively related to achievement gain, whereas student initiated contacts were positively correlated with achievement. It would seem, as Rosenshine suggests, that the availability of the teacher for answering questions is very important to the success of seatwork activities. The "covert" supervision provided in such settings may be the correct amount and type needed for effective instruction.

Management

Whereas monitoring refers more to the supervising behaviors teachers perform, management refers collectively to all the behaviors teachers exhibit to form the ground rules by which instruction and interaction occur in the classroom. Rosenshine (1977) Soar (1977) and Medley (1978b) discuss findings which relate to this variable.

Rosenshine (1977), in addressing teacher roles, draws from the results of studies by Stallings and Kaskowitz (1974), Soar (1973), and Solomon and Kendall (1976). He notes that teachers who played the role of strong leaders in their classrooms, i.e., "directed activities without giving their students choices, approached the subject matter in a direct, business-like way, organized learning around questions they posed, and occupied the center of attention" (p. 11), were the most successful in achieving student gains. The data thus suggest that more effective teachers exert the role of a powerful leader in order to manage the tasks and interactions of the classroom.

Rosenshine (1977) reinforces the notion of strong teacher control by first citing results from the study by Soar (1973) in which student free choice, student limited choice, and free work groups related to lower achievement, and secondly from the study by Stallings and Kaskowitz (1974), in which student selection of seating and work groups, and among several concurrent activities produced negative correlations with achievement gain. Both the Soar (1973) and the Stallings and Kaskowitz (1974) data were obtained for children of low SES. Another study which Rosenshine discusses (Solomon & Kendall, 1976) yielded similar results with children of middle SES. The study showed that classrooms in which students were allowed to choose their own activities, and were dependent on the class rather than on the teacher for planning, were disorderly and noisy, and were characterized by low achievement gains.

Soar (1977), in reviewing his own studies, came to essentially the same conclusions as Rosenshine did, but elaborated those conclusions by noting that an intermediate position with respect to teacher control is associated with the greatest pupil gains. He suggests that neither extreme degrees of teacher control nor extreme amounts of pupil freedom and free choice are functional, again reinforcing his notion of the curvilinearity of many functions relating classroom processes to student achievement.

Medley's (1978b) findings from three studies (Brophy & Evertson, 1974; Coker, Lorentz, & Coker, 1976; Harris & Serwer, 1966) suggest that teachers of classrooms showing high achievement gains devote less time to management than teachers of low achieving classrooms. In addition, findings imply that more effective teachers use lesser amounts of criticism to control their classrooms and depend instead on a much more varied set of managerial techniques.

Instruction

Results synthesized in this section reflect any relationships found between the content of instruction and student gain. Content of instruction, as used here, refers to any materials, patterns of sequencing and organization, methods of questioning, and the like that characterize the transmission (and reception) of information in the classroom.

The first variable of importance is what Rosenshine (1976, 1977) has termed "content covered" when referring to the opportunity students

have to learn the content on which they will be tested. Rosenshine (1976), citing data from Harris and Serwer (1966) and Pidgeon (1970), and in the 1977 paper, citing results from McDonald and Elias (1976), concludes that the amount of a subject covered is critical in determining student performance. Reduced to simple terms, these findings suggest that, if a student has not been taught what he or she is being tested for, then achievement will be low. Cooley and Leinhardt (1975) address this issue by creating a process variable category termed "criterion-relevant instruction," which refers to the degree to which a curriculum teaches what tests of achievement measure.

Basing his conclusions on the studies of Soar (1972, 1973), Stallings and Kaskowitz (1974), and Coker, Lorentz, and Coker (1976), Medley states that effective teachers of low SES pupils ask more lower order questions than ineffective teachers do, whether outcomes are computed for reading or arithmetic. From the Brophy and Evertson (1974) study, he concludes effective teachers also ask fewer questions that offer a limited choice of answers.

Medley also presents interesting results concerning the effectiveness of different teacher reaction patterns to pupil responses. He notes that in three studies--one a doctoral dissertation (Perham, 1973) and two from the fourteen he included in his analysis (Soar, 1973; Brophy & Evertson, 1974)--results indicate that effective teachers (of low SES pupils) are less likely to elaborate or discuss pupil answers than are ineffective teachers. Medley states that there is some

evidence (Stallings & Kaskowitz, 1974; Brophy & Evertson, 1974) that effective teachers acknowledge the pupil response or quickly provide feedback and then continue with the main task. In addition, Medley cites Coker, Lorentz, and Coker (1976), and Brophy and Evertson (1974) in saying that effective teachers are less likely to listen or provide feedback to pupil-initiated questions and comments. A quotation from Medley summarizes the questioning and response behaviors of effective teachers of low SES children.

> It seems clear that in low SES classes at this (primary) level, the competent teacher keeps interaction at a low level of complexity and pupil initiative. He or she does not encourage pupils to analyze, synthesize, evaluate, or indeed to do anything but answer rather narrow questions asked by the teacher. The teacher who encourages such pupils to express themselves freely, to think, to question, to discuss, is not effective in teaching them to read or do arithmetic. (Medley, 1978b, p. 17).

Results which are related to those found for teacher questioning and response patterns are those concerning child response patterns. Drawing primarily from the study of Stallings and Kaskowitz (1974), Rosenshine (1976) concludes that pupil responses to direct academic questions provude significant and positive correlations with achievements, whereas pupil responses to nonacademic questions and to open-ended questions correlate negatively with achievement. In addition, he cites the study by Brophy and Evertson (1974) when he says that the correctness of student answers was found to correlate differentially with achievement for low and high SES children. For low SES children,

the percent of correct answers significantly and positively correlated with achievement, whereas for high SES children, the percent of wrong answers showed a significant and positive correlation. Rosenshine interprets these results as suggesting that children of low SES should be asked questions near their level of ability in order to increase the probability of correct responses. In contrast, children of high SES should be asked questions slightly above their ability level, in order to challenge their thinking.

A fourth variable, which is also related to the two that have just been discussed, concerns the types of teaching activities that occur in the classroom, or what Rosenshine (1976, 1977) and Berliner and Rosenshine (1977) discuss under the heading "ways of spending direct instructional time." Looking at the data from the Brophy and Evertson (1974) study, Rosenshine, Rosenshine and Berliner, and Medley (1978b) note that low SES children profit more from seatwork or individually prescribed learning activities, and do not benefit from activities which require oral responses. For children of high SES the opposite of these results was found to be true.

A final issue that relates to the form instruction takes in the classroom is structure. Berliner and Rosenshine (1977) present the results of an ethnographic study conducted by Tikunoff, Berliner, and Rist (1975) to suggest that lesson structure, "defined primarily as the teachers' preparation of students for a particular lesson" (p. 382) is an important determinant of achievement. Teachers who

were identified as effective in producing high student achievement in the study informed students of the objectives of lessons, and of their own expectations for achievement, and linked current lessons with material previously studied. Thus it seems, as Berliner and Rosenshine conclude, that structuring, or "goal setting," relates significantly to students' acquisition of knowledge.

Environment

Classroom environment, perhaps one of the most frequently discussed issues in educational research, is the final variable for which results will be presented. Environment, in this section, refers to all the behaviors which contribute to the support and enhancement of the instructional tasks in the classroom. Several reviewers address this issue.

Medley (1978b), looking at the studies of Stallings and Kaskowitz (1974), Harris and Serwer (1966), and Brophy and Evertson (1974), concludes that effective teachers use more praise and positive motivation in their interactions with students. In addition, he notes that the results of one study (Stallings & Kaskowitz, 1974) suggest that effective teachers use more token reinforcements in their classrooms. The results of another study (Brophy & Evertson, 1974) imply that ineffective teachers make more frequent use of such things as gold stars and special privileges.

Rosenshine (1976, 1977) and Berliner and Rosenshine (1977) discuss

some other interesting findings of the Stallings and Kaskowitz study with respect to the provision of feedback by the teacher. In the Stallings and Kaskowitz study, data pertaining to student praise and criticism were categorized according to focus, either academic or nonacademic. As the reviewers note, the results of this study show that both teacher praise and criticism directed toward students are effective when focused on academic activities. In contrast, teacher feedback is negatively related to student achievement when given for nonacademic behaviors. The reader is reminded, however, that the sample for this study was composed of low SES students. Consequently, results may only apply to this socioeconomic group. Some related findings of Brophy and Evertson (1974), which Rosenshine (1976) notes, do seem to add to the credibility of these results. Rosenshine writes that in the Brophy and Evertson study, "within the high socio-economic status of classrooms, significant and negative correlations with achievement were obtained for (a) frequency of teacher questions about self, (b) procedural contacts, as compared to substantive contacts, and (c) student initiated contacts involving personal concerns" (p. 347). Negative but non-significant correlations were found for low SES students.

Soar's (1977) paper sheds some light on the differential utility of positive affect on low and high SES children. Basing his conclusions primarily on the results of one of his studies (Soar & Soar, 1973), he suggests that high SES students learn better in classes in which

teachers exhibit slight negative affect, whereas low SES students learn less in this type of environment. He notes that Brophy and Evertson's (1974) study revealed similar trends.

Rosenshine (1977) cites results of two studies which add to our understanding of feedback, and more clearly specify the qualities of an effective classroom environment. First, he notes the ethnographic study conducted by Tikunoff, Berliner, and Rist (1975), in which higher achieving classrooms were characterized as being "convivial, cooperative, democratic, and warm," whereas in the lower achieving classrooms there was more "belittling, shaming of students, and the use of sarcasm" (p. 20). In addition, Rosenshine writes that Solomon and Kendall (1976) also found that teacher criticism of student behavior, shouting, scolding, ridicule, and sarcasm were consistently negatively related to achievement gain" (p. 20).

One last finding is of interest. Medley (1978b) notes that results of five studies (Soar, 1973; McDonald & Elias, 1976; Brophy & Evertson, 1974; Bemis & Luft, 1970; Coker, Lorentz, & Coker, 1976) indicate that there is less deviant or disruptive behavior in the classes of effective teachers.

SUMMARY REMARKS

Despite its many flaws, process-product research (especially recent research) has produced a set of interim findings that educators and administrators may find useful in improving instructional practices in schools while awaiting more definitive results. In this report, these findings have been organized under the headings of time, instructional organization, monitoring, management, instruction, and environment. In sum, they suggest that the effective teacher (primarily of low SES children in the primary grades) is one who (1) uses time efficiently, keeping students engaged with task-related activities; (2) organizes students into medium to large groups for instruction; (3) correctly monitors work while being available to provide answers to student-initiated questions; (4) assumes the role of a strong leader; (5) asks low-order questions, ensures that students have the opportunity to learn sufficient amounts of content, keeps interaction at a low level of complexity, structures lessons so that students are aware of objectives; and (6) sustains a classroom environment that is warm, friendly, democratic, and relatively free of disruptive behavior.

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